



SALMONID ENHANCEMENT PROGRAM ¹⁹⁸⁷₁₉₈₈ UPDATE



Fisheries
and Oceans

Pêches
et Océans



Ministry of Environment

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Salmonid Enhancement Program
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SEP Expenditures by Program (in thousands of dollars)

Program Area	1986/87	1987/88
Enhancement Operations/Maintenance	\$ 17,557	\$ 17,667
Major Production Projects (construction)	3,075	3,745
Pilot Studies	287	-
Community Development Projects	4,264	1,520
Minor Production Projects	2,350	2,542
Public Involvement	1,418	4,665
Program Planning and Direction	559	752
Pacific Salmon Foundation	-	25
Lake Enrichment	2,370	1,887
Manageability/Environmental Studies	338	344
Reconnaissance/Feasibility Studies	604	622
Evaluation/Assessment Studies	859	753
Research Studies	2,568	2,662
Canada/U.S. Operations/Maintenance	1,656	1,911
Provincial Program (Federal share)	477	320
Provincial Program (Provincial share)	1,470	1,470
TOTAL	39,852	40,885
Source of Funds		
Dept. of Fisheries and Oceans	38,382	39,415
Provincial share	1,470	1,470
TOTAL	\$39,852	\$ 40,885

A federal commitment to SEP

Several significant events and developments stand out from the background of 1987.

Each brings to mind its own key word or phrase. Taken together, these provide a picture of SEP as it operated in 1987.

FUNDING

Stability is the major impact from Minister of Fisheries and Oceans' Tom Siddon's June 23 announcement of assured funding through 1991. As the Minister noted, "In the last decade of the twentieth century, SEP is expected to account for about one third of B.C. salmonid production." To achieve such contributions, the program needs the stability assured funding can bring.

CONSULTATION

SEP's vision is broadened by its consultative process. SEP must always look at least five years ahead and seek a wide variety of opinion in developing plans. The current plan running until 1991/92 was seen, studied and commented on by the Salmonid Enhancement Task Group, the Sport Fishing Advisory Board, the United Fishermen and Allied Workers Union, the Fisheries Council of B.C., the Pacific Area Regional Council and the Aboriginal Peoples Fisheries Commission.

The very variety of their interests and opinions gives the process its strength. A vision wide enough for the future can only come from

a distillation of many points of view and a consolidation of much expertise.

THE FRASER RIVER

Opportunity is the word one associates with the Fraser River. This is, historically, the greatest of salmon rivers. Its runs suffered frightful declines when blockages occurred at Hells Gate — declines that were only partially offset by the construction of the Hells Gate fishway some forty years ago. With the Canada-United States treaty now in place, the Fraser offers a major opportunity for enhancement strategies. SEP is investigating options for spawning channels, more fishways and lake enrichment. Fish passage problems at Hells Gate and Saddle Rock are receiving immediate attention. As well, problems associated with uneven waterflows in the interior of the province are under study. Many potential salmon streams dry up in the summer. If these areas can be assured adequate water, production increases will be substantial.

CHINOOK

Concern is one's initial 1987 response to the word chinook, especially around Georgia Strait waters. This concern, for many knowledgeable people, began some years ago. The recent, drastic decline in returns has served one positive purpose — it has spread that concern. As these concerns grew, SEP responded to the situation, meeting with fisheries managers to develop a joint program. As 1987 drew to a close, plans were being developed for a combination of management and enhancement strategies to reverse the decline.

RESEARCH

Keys to the future are to be found through research. Much more

knowledge will be needed if problems with chinook stocks are to be solved, if the Fraser's opportunities are to be fully realized and if we are to respond appropriately to various ocean conditions. The Marine Survival of Salmon (MASS) studies address one of the keys to good fisheries enhancement and management — ocean survivals. MASS involves scientists from a wide variety of both fisheries and oceans sciences. Their combined expertise will begin to unlock the famed "black box" of the open Pacific.

THE FUTURE

Optimism may best describe the view of SEP's future as 1987 closes. We will always face problems with a complex, living and migratory resource. We have, however, gained many advantages in

recent years. Opportunities have resulted from the Canada-United States Pacific Salmon Treaty. Assured funding gives SEP stability as it seeks to develop those opportunities. As well, all SEP efforts will continue to benefit from research findings, from an educated and informed client group, and from the consultative process.

As the Honourable Tom Siddon stated in the first issue of *Pacific Tidings*, "We have built up a solid array of enhancement techniques so that we are increasingly able to make a good match between a given stream and species and the most effective enhancement method." That good match assures a sound, productive future for the program and for the salmonid resource on the Pacific Coast.

**The MASS
project . . .
will begin to
unlock the famed
"black box" of
the open Pacific.**

H. SWAN
Director, SEP, 1987

Spawning channel saves land and improves habitat

When Rheal Finnigan learned that the Water Management Branch of the B.C. Ministry of Environment and Parks was planning a diking project on the Cowichan River, he made them an offer they couldn't refuse.

After meeting with the multi-agency committee planning the diking project, Finnigan, the senior engineer with SEP's Small Projects Unit, suggested a way to improve fish habitat while saving land, by improving Rotary Park Creek, a drying, overgrown channel parallel to the dike just east of Highway 1, in Duncan. The material excavated from his project would provide fill for the dike.

He envisioned the intermittent creek as an ideal groundwater-fed side channel and as a way to reduce the amount of land alienated by the dike.

Small Projects senior biologist Dave Marshall, together with Finnigan, pioneered these low-cost, low-maintenance spawning channels. They have built more than 30 throughout B.C. since 1974.

The technique involves use of old flood channels with little or no surface water flow. Vegetation and topsoil are stripped off and the gravel bed dug deeper to allow a steady stream of groundwater to fill the channel. Banks are rock lined to prevent spawning salmon from eroding the stream edges. Finally the banks are seeded, or simply left to allow vegetation to recreate a natural environment.

Other than "going in twice a year to have a look," the channels need little attention from SEP after

construction is completed, says Greg Bonnell, biologist for the project. SEP approached the Water Management Branch with the proposal for Rotary Park in 1986. The committee, composed of representatives from Water Management, DFO Habitat Management,

the City of Duncan, the provincial Fisheries Branch and the Cowichan Fish and Game Association, had been planning the project for some time, and agreed to include SEP's proposal.

SEP's involvement included surveying, design, preparation of working drawings and community liaison to gain support from adjacent property owners. Work began in August of 1987, with Small Projects engineer Harold Beardmore and Bonnell overseeing construction. Spawning beds were created along 600 metres of the old channel and two new ponds were created for trout overwintering. Duncan fishery officers reported as many as 10,000 fish spawned in the new

channel in the fall of 1987 — mostly chum, some coho. "We believe it, because when we were hydraulic sampling in February, we found eggs everywhere. Virtually every square metre was spawned," Bonnell says.

The sampling determined a 65 percent survival to the eyed egg and alevin stage, compared to 10 to 20 percent in natural beds. Forty to 60 percent is considered good. Ground-water fed side channels have many advantages over natural stream beds. There is no danger of



floods washing away eggs or scouring gravel spawning beds. Silting and subsequent suffocation of eggs is eliminated. The water is exceptionally clear, the flow is constant and temperature moderate, encouraging production of larvae and insects, and reducing the risk of eggs freezing.

Based on studies at similar channels, Bonnell projects an annual production of one million chum fry and 4,000 coho smolts starting in 1988 (in addition to 15,000 smolts produced before the work was done).

Water Management paid most of the \$40,000 cost, and were able to use much of the excavated material for the dike. SEP's entire outlay for the project was \$5,000. ■

The finished product. Rotary Park Creek is no longer a swampy breeding ground for mosquitos, but a near-perfect environment for spawning chum and coho.

Pink and sockeye a priority on the Fraser

SEP's plans for the Fraser's future are tied to the past, particularly the absence, over the past 15 years, of new sockeye and pink salmon enhancement.



Sockeye returning to the Fraser.

That absence was due to the reluctance of the federal government to spend money on the Fraser without an agreement ensuring Canadian, not American, fishermen would reap the the benefits of

pink and sockeye in the Fraser, Lill says.

The Fraser, however, is one of the more complicated systems to work with, since it accounts for 30 percent of the B.C. salmon production, with many runs and varying stocks of each species. The trick is to enhance stocks artificially without offsetting the gain by the destruction of natural stocks, says Lill.

All enhancement activities must be supportive of rebuilding natural stocks or creating new stocks which do not impact on natural stocks. A second concern is that because of predation and competition among species, an increase in one species could lead to a decrease in another, independent of harvesting pressure. What SEP looks for is what Lill refers to as "windows," areas where

enhancement projects can be undertaken without adverse effects on wild or other enhanced stocks, in locations where benefits justify cost.

A number of these windows have been determined through many surveys and studies by biologists, the habitat protection division and district supervisors.

Three main enhancement technologies will be employed: construction of fish passageways; spawning ground improvements and lake enrichment. Considerable potential exists for temporary pilot hatcheries to rebuild depressed stocks or use barren habitat by transplanting.

A major goal for SEP is improvement of fish passage in the Fraser Canyon. At Hells Gate, major rock slides in 1913 and 1914 devastated sockeye and pink stocks. Major fishways constructed here in the '40s have generally worked well for sockeye, but pink are weaker swimmers, and tend to arrive in large numbers when water levels have dropped below the level of the main fishways at Hells Gate.

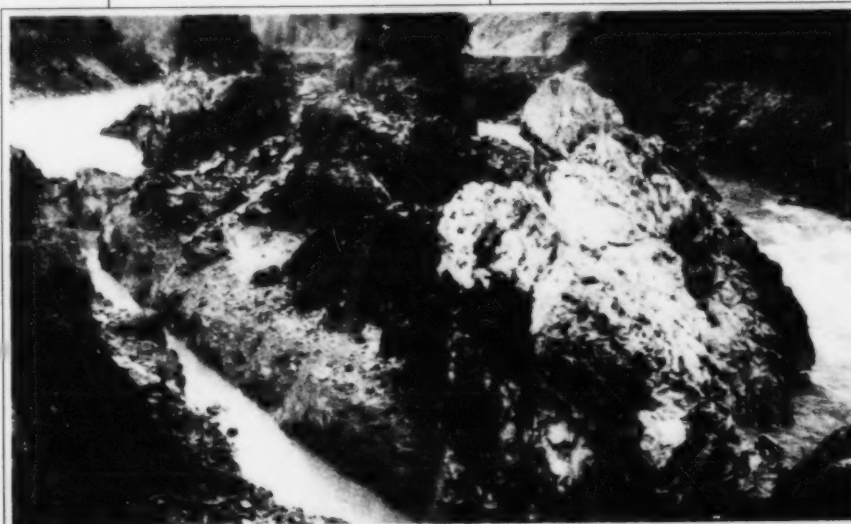
Obstructions for pink salmon are also evident at certain water conditions at other locations. During February 1988 a fish passageway was cut and

Passageway for pink salmon (foreground), cut and blasted out early in 1988, will provide a calmer route past the rapids at Saddle Rock in the Fraser.

salmon returning to the Fraser River.

Al Lill, chief engineer of SEP's engineering division, says those concerns were addressed by the Pacific Salmon Treaty between the two countries, signed March 18, 1985. Lill says the big news of 1987 was federal Minister of Fisheries and Oceans Tom Siddon's announcement of stabilized funding for SEP, "because it puts us on a sound footing for the first time."

Siddon's commitment to SEP of \$208 million over the next five years represents an extra \$100 million in federal funds to SEP in that period. With the funding in place, the major priority in the next five years is to get on with the pent-up demand for enhancing



blasted through rock at Saddle Rock, up-stream of Yale.

SEP Engineering plans for 1988 and ensuing years include construction of passage improvements at Little Hells Gate and possibly China Bar, a new low level fishway at Hells Gate and fishways on up-stream rivers.

Spawning channels and bank stabilization are a second method of enhancement. The Horsefly, a major sockeye river, has a big run only every four years. Spawning channels could enhance runs in off years and help redistribute fish to less utilized areas.

Coupled with spawning channels, productivity of lakes must be addressed. Fertilization of Chilko Lake begins in 1988 and possibly Quesnel Lake in 1990 or 1994. The lakes, once fertilized by the carcasses of dead fish, have seen dramatic loss of nutrients with the increase in fishing. Salmon runs on many interior streams and rivers were devastated by gold panners and hydraulic miners in the mid-to-late 1800s. Some of these streams are still devoid of salmon, and offer tremendous potential.

While the Lower Adams River is renowned for its sockeye runs, in the Upper Adams, sockeye stocks were completely wiped out by a dam before World War I. Construction and operation of an expanded pilot hatchery is being undertaken in 1988 aimed at eventually creating a self-sustaining run in the Upper Adams.

On the Fraser River, drought has been a major problem in the past few years, and on some salmon producing streams there are heavy irrigation demands, creating chronic water shortages for spawning fish.

Construction of flow control dams to conserve and regulate water in times of shortage, and implementation of more efficient irrigation methods, are among the main solutions SEP is using to combat this problem. ■

Kitimat hatchery comes on line

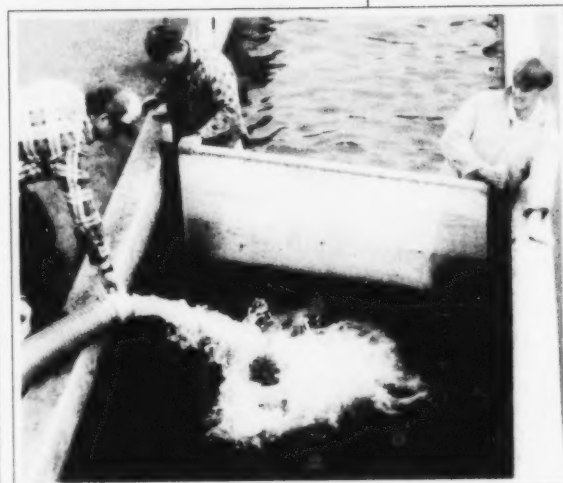
"The word is out on the Kitimat River," says Kitimat Hatchery manager Dave McNeil, who says the days of peaceful, uncrowded sport fishing may be over.

The word is that production at the hatchery, upgraded from a small facility to a permanent \$9.6 million hatchery in 1984, has come on line, with phenomenal first returns of steelhead in the spring of 1988. There was good news too for commercial fishermen, with exceptional returns of three-year-old chum in the fall of 1987.

"There clearly were thousands . . . in the tens of thousands (of chum), and really large fish – ten and 12 pounds, although there were lots in the five to seven pound range.

"That was pretty impressive, but the most dramatic thing was the spring of 1988," says McNeil, when the first major returns of steelhead from the '84 brood, released in 1985, came back. "That was really dramatic, everyone was catching steelhead, even people who had never fished before, old people and little kids."

McNeil says Kitimat has always been a "reasonably good steelhead river, but nothing like this year (spring, 1988)."



"People were going out during lunch to fish, and catching up to five or six," says McNeil. And the fish were big. "The largest we heard of was 25 pounds, 17 pounders were common and many weighed 10 to 12 pounds." At least half the fish being caught were hatchery marked.

The Kitimat River was one of SEP's earliest concerns. Most stocks, particularly chinook, were seriously depleted. The pilot project began in 1977, incubating chinook eggs in a corner of Eurocan Pulp and Paper's pumphouse. The fry were reared in an Atco trailer plumbed as a portable hatchery to overcome the cold of Kitimat winters.

About 70,000 chinook were released that first year, and resulted in a doubling of the river's chinook run. The success of the pilot project led to the decision to establish a permanent hatchery in 1984. The initial co-operation of Eurocan has continued to this day, says McNeil. Modifications by the company this year have resulted in a water supply increase to 1,000 gallons per minute. Because of the harsh winters, SEP engineering designed the hatchery specifically for Kitimat, using Eurocan's heated waste water run through a heat exchanger to warm river water for

Chum brood stock are crowded to one end of the channel and a pump is set up to suck the fish into a transport truck.

Continued on p.6

incubation and rearing. This allows the hatchery to release smolts significantly larger than wild reared fish of the same age. Because of the climate, chum rearing and intermediate rearing channels are inside the hatchery.

From the initial 70,000 chinook released in 1977, production increased 10 years later to more than 2.6 million chinook. The hatchery works with a large range of stocks. The 1987 release included chinook stocks from the upper Kitimat River (175,700), the lower Kitimat (1.956 million), Hirsch Creek (231,460), Dala Creek (7,230) and Kildala (300,600). The 1987 releases also included 947,946 chum, 594,496 coho and 55,681 steelhead.

The project's success has been outstanding. Kitimat chinook are showing signs of becoming one of the most desirable sport fish in the area. Returning chinook in recent years were impressively large, the average weight in the range of 15.9 to 18 kg (35-40 lbs). The largest sport-caught to date weighed in at 24.5 kg (54 pounds). But McNeil says that in terms of returns, the hatchery is still fairly new.

"We are still waiting for the first major return of chinook, the four-year-olds from the '84 brood and the five-year-olds from the '83 brood." McNeil is reluctant to make predictions, because things have gone so unusually well for the hatchery so far.

"But we are expecting a pretty significant return (of chinook both in 1988 and 1989)."

If so, the peaceful, uncrowded days of sport fishing on the Kitimat River may indeed be over. And an important run of chum salmon, which had been decimated by overfishing and environmental destruction, is showing signs of being completely restored. ■

Tiny wire a powerful tool in SEP planning

The Mark Recovery Program (MRP) was begun on an experimental basis in B.C. in the early 1970s. Some of the early statistics were used to support establishment of the SEP program. The figures showed that existing hatcheries were contributing significantly to the fishery and that further projects under SEP were worthwhile.

By the early 1980s, as negotiations proceeded towards a joint Canada-U.S. fishing treaty, it became apparent that the data collected were also valuable in setting fishing allotments or closures that coincide with migrations, says Margaret Birch, manager of DFO's Salmon Services Unit. MRP was incorporated into the terms of the Pacific Salmon Treaty and long-term funding was guaranteed.

Juvenile salmonids are tagged with a 1.2 mm sliver of coded wire, inserted into the nose cartilage of juveniles before release. The adipose fin is clipped to identify tagged fish. The tag tells fisheries staff where and when the marked fish was released. Records at Salmon Services Unit's data centre give particulars on size and rearing conditions and the number of tagged and untagged fish released.

To illustrate how the tagging system works, Birch used statistics from a group of fish released from Robertson Creek Hatchery in the spring of 1985. Fisheries samples only 20 percent of the landed commercial salmon catch, so the observed tagged catch must be expanded to indicate tagged fish probably caught. Tagged fish

Release and recovery data are essential to good fisheries management and SEP planning.

represent only a fraction of the larger group released so a second estimate, based on the percentage of tagged to untagged fish, must be extrapolated.

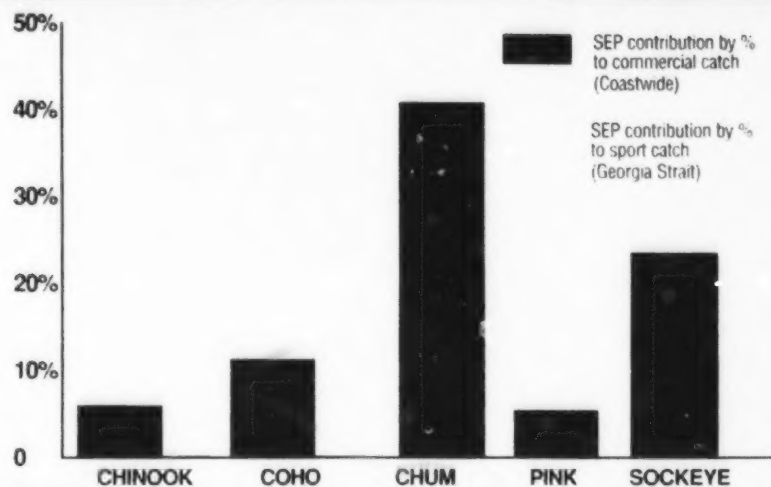
The file pulled from Birch's immense data bank shows 18,823 hatchery chinook

were tagged with code 02-31-51 and released the first week of June 1985 with 747,900 untagged fish at 8.2 grams. In the total 1987 B.C. troll fishery, seventeen 02-31-51 tags were recovered. To the number crunchers at Salmon Services, this indicates that this group contributed 2,357 adults to the troll fishery coastwide.

The logistics of operating such a program are immense. Apart from the tagging, locating a tagged fish in the commercial catch is a major challenge since it is visible only by a clipped adipose fin. In 1987 ten million juveniles were tagged and released. About 1.5 million commercially caught fish were sampled and 39,571 heads recovered.

Dissecting the head in search of the tiny tag is time consuming, and recording release and recovery data and interpreting results are major undertakings. "Nevertheless, there is simply no other way to obtain many of the data the program generates," says Birch. ■

SEP CONTRIBUTION TO 1987 SPORT AND COMMERCIAL CATCHES



SEP CONTRIBUTION TO 1987 SPORT AND COMMERCIAL CATCHES (BY AREA)

NORTH COAST - COMMERCIAL

	Catch	SEP	SEP%
Chinook	274,444	24,269	9
Coho	888,826	46,523	5
Chum	1,357,055	274,259	20
Pink	10,270,598	0	0
Sockeye	1,962,272	691,100	35

SOUTH COAST - COMMERCIAL

	Catch	SEP	SEP%
Chinook	490,065	19,168	4
Coho	2,459,311	337,352	14
Chum	931,284	668,856	72
Pink	2,945,689	629,794	21
Sockeye	2,812,895	461,730	16

FRASER RIVER - COMMERCIAL

	Catch	SEP	SEP%
Chinook	13,546	541	4
Coho	11,429	3,572	31
Chum	10,162	0	0
Pink	140,268	16,900	12
Sockeye	610,879	69,870	11

GEORGIA STRAIT - SPORT

	Catch	SEP	SEP%
Chinook	121,082	16,775	14
Coho	641,573	234,906	37

Radio tagging reduces incidental catch

The Dean River, with a world-wide reputation as a summer steelhead river, was recently designated a "special fishery" in a bid to conserve the quality of angling.

Coola pink and chum. A consultant's study in 1986 showed more than 13,000 steelhead intercepted by Area 8 seine and gillnet fisheries.

Ian McGregor, rivers biologist, Fisheries Branch, Kamloops, said the large catch reflected a "bumper crop" of steelhead and above

average fishery pressure. Steelhead escapement of 7,000 to the Dean in 1986 was "not bad," but the provincial Fisheries' concern is that a year of weak steelhead returns, combined with a strong fishery could curtail Dean angling, and pose a serious conservation threat.



A tagged Dean River steelhead is released back into the ocean.

Towards this goal the provincial Fisheries Branch, in 1987, began a radio tagging study of Dean steelhead. The study is aimed at reducing the incidental steelhead catch in the Area 8 chum, pink and sockeye fishery. (Area 8 comprises the central coast of B.C. — all the salt water east of Bella Bella, including Dean, Burke and Fisher Channels and North and South Bentinck Arms.) The steelhead migration through Area 8 waters overlaps the peak migration of pink, chum and sockeye runs, specifically the Kimsquit chum and Atnarko/Bella

Radio telemetry was chosen as the best method to gain migration data and to gather information on in-river migration of Dean steelhead, especially the rate steelhead move through the sport fishery. Survival of steelhead caught by and released from seiners was assessed and different areas of Area 8 were investigated as sites of high steelhead interception. Steelhead were collected from July 8 to August 13, 1987. A total of 109 steelhead were captured. Of those, 37 were radio tagged and 62 received just a 30 cm spaghetti

tag. To determine the time of entry into the Dean, a stationary recording receiver was set up at the river's mouth. Subsequent tracking up the river was carried out by Fisheries Branch officers from jet boats, land vehicles or on foot, and above kilometre eight, by Lower Dean Guiding Service. Beyond kilometre 30, radio tagged fish were monitored by aircraft.

Of the 37 radio tagged fish, 21 reached the Dean still tagged. Another was caught by an angler in the Lower Dean, five were caught by commercial gillnetters and another turned up at a Vancouver Island cannery, apparently caught by a seiner in Hakai Pass. The travel rates of radio tagged fish to the mouth of the Dean varied from seven to 41 km per day, a mean rate of about 17 km per day. Since the tagged fish couldn't be tracked in salt water (because of salinity and depths travelled), day-to-day movements could not be determined.

However, several fish were caught down the channel from their initial release location, and a few others not far from where they were tagged, indicating steelhead may not travel a direct route to the Dean. Steelhead were also radio tagged in the Dean River, primarily to fill in run segments when no ocean tagging was carried out. River migration rates have only been established for ocean tagged fish in the lower canyon sections of the Dean. The time spent migrating from the mouth to the canyon (3.9 km) ranged from 0.1 day to 20.1 days, with a mean time of 2.6 days.

Travel through the 0.6 km Dean Canyon was relatively slow. Radio tagged fish spent an average of 8.7 days in the canyon area. The second phase of the program, sonic tagging, will allow tracking through salt water and should give specific migration routes and rates of travel, McGregor said. New gear and closure regulations will await assessment of the 1988 study. ■

Small hatchery makes big contribution

For a small facility, more geared for education than production, the Bell-Irving Hatchery on Kanaka Creek in Maple Ridge is making significant contributions to both commercial and sport fishing, and to revitalized coho, chum, steelhead and cutthroat trout.

When the hatchery, 1.5 km south of Dewdney Trunk Road on 256th Street, opened in 1983, coho runs on the creek averaged between 200 and 400 spawners. There were between 1,000 to 1,500 adult chum returning.

"The counting fence was run last fall 24 hours a day, so we have a very accurate count," says Gary Taccogna, acting head of SEP's Public Involvement Program. The count showed 1,500 coho and 5,000 chum came back to the stream. Coho tag recoveries indicate an 11 to 12 per cent smolt to adult survival. Bell-Irving is a public involvement

hatchery, primarily funded by groups other than DFO, which contributes about \$12,000 per year. The main hatchery funding comes from the Northern Save the Salmon Society, and the Greater

Vancouver Regional District. The provincial Ministry of Environment and Parks, Fisheries Branch, provides funds for steelhead and cutthroat trout enhancement. A coded-wire tagging program has shown that, apart from increased spawning runs, a small hatchery can also contribute significantly to both commercial and sport fisheries coast-wide. Of 23,900 coho (brood year 1984) released in 1986, virtually all (23,757) were coded-wire tagged. Mark Recovery Program data indicate 1,880 Bell-Irving coho from that release were



caught coast-wide, in 1987 (see table below). "This is an example of what a volunteer community project can contribute, making fish for the fisheries

and also building the runs in the creeks, at the same time fulfilling the other role of educating the public," says Taccogna. "It is not meant as a production facility, the focus is educational," he says. The hatchery contains a classroom for instruction for school children from throughout the Lower Mainland who tour the facility, and for seminars for new comers to the Salmonid Enhancement Program.

Manager John Heaven says he would like to see even more emphasis put on the educational role of the facility. Heaven says the number of visitors to the hatchery, mostly elementary school students on tour, has grown from 1,100 in 1985 to 5,400 in 1987, spurred on by the interest in enhancement generated by SEP's Salmonids in the Classroom program. "If we can educate the kids now [about environmental concerns] then a lot of problems down the road will resolve themselves."

Children release smolts at the Bell-Irving hatchery open house. The small facility provides the community with an opportunity for salmonid education, but is also making significant contributions to commercial and sport fishing.

**KANAKA CREEK
DISTRIBUTION OF OBSERVED AND ESTIMATED CATCHES
OF CODED-WIRE TAGGED COHO**

Catch Region	Gear Type	Statistical Areas	Observed	Estimated Catch
Northern Coast	Troll	1-5	1	5
South-Central Coast	Troll	10-12	7	26
Johnstone Strait	Net	12-13	10	24
Georgia Strait	Troll	13-18,29	86	402
Georgia Strait	Net	14-18	9	19
Georgia Strait	Sport	12-30,28,29	150	760-850
Juan de Fuca	Net	20	44	122
Fraser	Net	29	2	2
Vancouver Island:				
West Coast	Sport	21-27	3	3
South West Coast	Troll	21,23,24	73	410
North West Coast	Troll	25-27	9	57

Bella Bella exceeds production target

After a "nearly complete wipeout" in its first year of production, and years of poor incubation and survival, the Bella Bella hatchery is finally a success.

In 1987, for the first time, Bella Bella met its production target of 1.6 million chum eggs and exceeded the target of 100,000 coho eggs by 55,000. "The first year had a high crew turnover and poor management," says Maurice Coulter-Boisvert, SEP Project Coordinator.

The poor incubation and survival was attributed to the extremely low pH level of the water, during winter months. A number of experiments led to buffering the water with limestone, which has resulted in near normal incubation survival.

Coulter-Boisvert says that of the seven CEDP projects he coordinates, Bella Bella is the most improved, mainly because of an eager and diligent manager, a co-operative band administration and increased crew stability.

CEDP (Community Economic Development Program) projects are operated in 28 B.C. communities by local groups under contract to the Salmonid Enhancement Program. The projects emphasize fish production, training in fish culture and project management and economic development.

The hatchery, about 1 km south of Waglisla (formerly Bella Bella), is operated by the Heiltsuk Indian Band Council.

In addition to the project coordinator, SEP provides a project advisor for onsite training of employees. Biological and engineering support is provided through the Small Projects Unit of the Special Projects Division.

Under new project manager Jackie Larsen, with a stable crew able to benefit from the SEP-provided training, the rate of incubation survival is now 80 percent or better, compared to an 80 percent mortality rate, or worse, previously. 1.3 million '87 brood chum at 1.5 grams were released in the spring of 1988, and 50,000 coho each from MacLaughlin and Kakusdish will be raised to full term smolt.

The project had an unexpected bonus in the size of its MacLaughlin Creek chum escapement, with 10,268 adults returning. Based on the biostandards, only 6,400 had been anticipated. The result was that for the first time a commercial fishery was held to harvest the MacLaughlin

over-escapement, with 6,000 adult chum caught.

In 1988 Coulter-Boisvert expects 20,000 to 30,000 chum in excess of the facility's requirements for brood stock.

While the hatchery offers direct employment to only a manager, two full time crew and some part time workers, its success promises far greater benefits for the band, the

nearby non-native community of Shearwater and the Department of Fisheries and Oceans.

The hatchery provides the band with operating and administrative experience, and increased salmon runs will mean an increased food fishery, more opportunities in guiding or other sport fishing ventures, and a potential increase in fish processing jobs.

Shearwater attracts people from all over the world for sport fishing, so increased salmon stocks offer an important regional economic opportunity in tourism development.

And for Fisheries and Oceans, the Bella Bella project has improved the department's relations with the band, and improved information on escapement, size and age of fish, downstream movements, stream counts, migration patterns, and other statistics.

With the incubation and survival problems solved, and a solid administrative/management team and stable work force, Coulter-Boisvert foresees the success story continuing in 1988. ■

Heiltsuk Band members tag fry at the Bella Bella hatchery. In 1987 the contractors met or exceeded egg-take targets, and witnessed excellent adult chum returns.



Yellow fish symbol of growing awareness

The yellow fish stencil showing up on storm drains throughout the Lower Mainland conveys more than just a warning against dumping toxic wastes, says Gary Taccogna, acting head of DFO's Public Involvement Program.

The fish symbolizes a growing public awareness, starting with the young volunteers who conduct the stencilling program, and rippling out to their parents and the community.

The children learn of the dangers of toxic wastes to the environment, particularly to the fish, in streams and rivers into which the drains empty. Then they pass the information on to their parents, and through brochures distributed to homes in the area of the marked drains, to the community. "The more educated people we have out in the community, the better chance we have of protecting the streams," Taccogna says.

Awareness should result not only in less dumping, but more reporting of people who endanger salmon streams, he hopes. He says many people assume storm drains lead to sewage treatment facilities, unaware they empty into streams, and also unaware of the presence of fish in the streams.

It is not surprising then that much of the toxic chemicals causing fish kills originate in residential neighbour-



hoods, dumped by ignorant or uncaring people. The pollutants include many toxic household or car maintenance products, from antifreeze and paint thinner to pesticides or insecticides. In

some cases swimming pools have been emptied into storm drains, the

heavily chlorinated water creating a huge toxic surge into salmon streams.

The marking program got underway in early 1987, a joint project of the federal and provincial fisheries departments. Marking began on the north shore of the Fraser River, but has now spread to most Lower Mainland districts. People wishing to get involved contact DFO's community advisor in their area. A volunteer adult co-ordinator oversees the volunteers, mostly guide and scout troops and students.

The co-ordinator gets assistance to train the volunteers, a map of the drain locations, informational brochures for distribution to area homes, and a paint cart stocked with supplies. The popularity and rapid growth of the program has made it difficult to estimate how many drains have been marked, but those figures will be tabulated through a provincial summer employment project during 1988.

"Publicity has been excellent. I think we have created a bit of a monster, we're having a hard time keeping up with it," Taccogna says. ■

Painting a reminder, students mark storm drains with a yellow fish.

From garden shed to modern hatchery

A Public Involvement Project hatchery at Gold River has grown from a garden shed releasing 12,000 chinook in 1984, to a sophisticated facility in just three years, says community advisor George Bates.

The initial modest release in 1984 of one stock (11,837 Gold River chinook) increased in 1987 to 300,000 Gold River chinook, 50,000 Gold River coho and 40,000 Burman River chinook.

Under the auspices of the Gold River Rod and Gun Club, the original garden shed, with a half stack of Heath trays and one Capilano trough, was set up on

Continued on p. 12

Canadian Pacific Forest Products' Gold River pulp mill site, using heat from the pulping process to warm the water for the facility.

In the second year a larger shed was built and 38,000 chinook and 5,000 coho were reared and released in Gold River. Hatchery manager Dale Frame says that at this point the volunteers decided to go into the production in a major way, and because the project was too big for the Rod and Gun Club, a new group was formed, The Gold River Chinook Project, specifically to operate the hatchery.

With the assistance of the Conuma River hatchery, the volunteers at Gold River reared and released about 225,000 salmon including more than 80,000 Burman River chinook, in 1986.

Then with the blessing of the pulp company, which was willing to provide the land, plumbing, electrical work and some materials, the volunteers went ahead with their plans to expand further.

"I couldn't believe the enthusiasm these people put into their project," says Bates, who estimates replacement costs for the new facility at about \$300,000.

The new facility boasts two incubation buildings, four Capilano troughs and a 45 metre concrete rearing channel which can hold up to one million chinook to the five gram stage.

Frame said the hatchery would be releasing 350,000 chinook and 125,000 coho in 1988. Frame calls the project a "family affair" and says he can get 30 volunteers to show up at the hatchery. "This is a community where you either fish or hunt, or you have nothing to do, so it works out real well." ■

"Quinsam 5" program adopted as curriculum

When Quinsam Hatchery manager Jim Van Tine set out to promote Salmonids in the Classroom, he had no idea his efforts would lead to a new program, so popular it has been made part of the curriculum by Campbell River School Board.

"We decided to help the teacher use the material in Salmonids in the Classroom but it turned out that that was not to be."

The initial "Salmonids" program was "just too large," Van Tine says. Despite a later revision, "I still saw three huge binders - excellent material, but the school system wasn't using it a lot. The need we identified was something smaller, that would relate to this community and this hatchery."

With a job creation grant, a teacher and an environmentalist were hired to assist Van Tine create the program. A module was developed and it was demonstrated by the teacher hired through the grant in each Grade 5 class in Campbell River, about 15 to 20 classes.

The program was well received by the teachers. Linda Bermbach, SEP's education co-ordinator and one of the principal authors of *Salmonids in the Classroom*, was called upon to "polish it up."

The result was *Quinsam Five*, a program for Grade 5 students that so impressed the Campbell River School Board that they incorporated it into the curriculum. The lessons are written in such a way that the children learn about salmonid enhancement and

environmental protection while studying math, science and literature.

The program includes a story by Bermbach, about children caught throwing rocks at fish, who learn a new respect for the environment through volunteer work at Quinsam Hatchery. A tour of the hatchery during spawning is also part of the program.

The popularity of the Grade 5 program led Van Tine and his assistants to create a Grade 2 introductory program, and now, the school board itself is developing a program for Grades 9, 10 and 11. For the first time, the initiative is on the part of the school board, with DFO lending expertise on a module on reproductive biology and another on habitat.

Van Tine says his initial goal was a modest one, to promote salmonid studies in the classroom, and the acceptance by the school district was a bonus. While educational work is "very much a sideline," to the hatchery's main purpose of producing fish, it has paid off because of the commitment of the school board and the teachers.

"Now most of the kids in Campbell River are subjected to this thing," he says with a laugh. ■

MASS probes early ocean survival

The Marine Survival of Salmon (MASS) program focuses on the early marine life of salmon and the relationship between oceanographic events, dispersal and survival in the first months at sea, and ultimately by the contribution of adults to the fisheries.

Dr. Mike Healey, Salmon Dynamics, Pacific Biological Station, Nanaimo, said the studies will permit more accurate estimates of juvenile salmon survival rates, and assist fisheries managers in future enhancement efforts.

Program planning began in 1986, with the first studies undertaken in the spring of 1987. Participants include scientists and support staff from the Biological Sciences and Physical and Chemical Sciences branches of DFO and the Marine Birds Division of the Canadian Wildlife Service. In addition, work on predation mortality received considerable manpower and logistic support from the Salmonid Enhancement Program.

Specific salmon populations under investigation include sockeye salmon from the Alberni Inlet system, chinook and coho from Robertson Creek Hatchery and juvenile chinook and coho of various origins on fishing banks off southwestern Vancouver Island.

The MASS approach is three pronged. One studies the direct effects of coastal circulation and water mass structure on the dispersion and migratory behaviour of juvenile salmon. The second examines the relationship between food chain productivity, food distribution and survival. The third is the study of predation mortality of young salmon.

Migratory route data collected in the

87/88 fiscal year show sockeye smolts were abundant in Alberni Inlet from mid-April to mid-June and smolts migrated through Barkley Sound at a steady speed of about 3 - 5 km per day along a direct route from the head of Alberni Inlet to Amphitrite Point.

Hydroacoustic studies of sockeye smolt migration indicate they travel in the upper 10 m of water, are more active in ebb than flood, and in the first few hours after sunrise.

Chinook smolts caught during May and June originated mainly from Robertson Creek Hatchery.

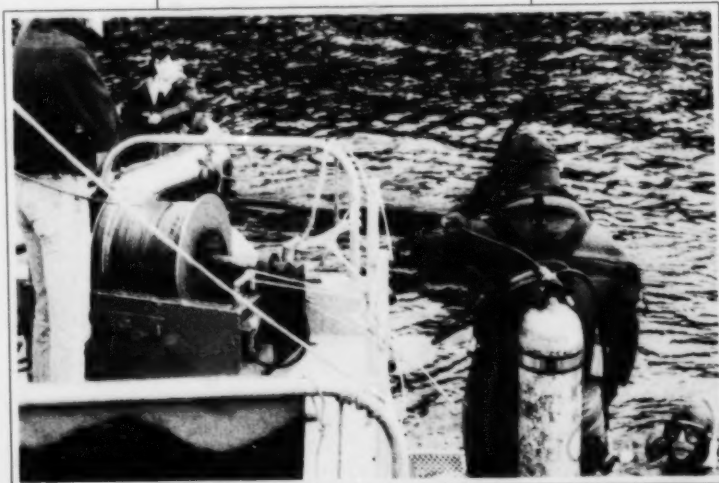
The hatchery chinook were found to move rapidly to the ocean but remain in Alberni Inlet for two to three weeks, and in Alberni Inlet and Barkley Sound much longer than either sockeye or coho. Robertson Creek coho move rapidly into the ocean soon after release and most go directly out to sea.

In September juvenile salmon densities were close to four times higher on Swiftsure than on Amphitrite. Coho were by far the most numerous, but chinook numbers increased dramatically

after the fall transition in oceanographic circulation, indicating juvenile salmon undergo a redistribution over the banks during the transition.

Sampling of predators in 1987 found insignificant mortality of juvenile salmon from either birds or mammals, and few of the fish predators examined were preying on juvenile salmon.

A survey of plankton distribution and productivity patterns in Alberni Inlet and Barkley Sound indicated that the greatest relative abundance of large-bodied zooplankton roughly coincided with the highest juvenile sockeye abundance. Other projects included surveys of the formation of eddies on the continental shelf



and their importance as food trapping or resting areas for small fish. Numerical modelling of Barkley Sound circulation patterns, studies of Landsat and weather satellite data and airborne imagery flights will determine the effect of thermal structures and plankton circulation patterns on juvenile salmon.

MASS's annual report is available from Dr. Terry Beacham, Fisheries and Oceans, Pacific Biological Station, Nanaimo, V9R 5K6. ■

Placing an upward looking echo sounder on the bottom of Barkley Sound. It will follow the movement of juvenile salmon on their way to the Pacific Ocean.

Species	Juveniles Released	Expected Adult Production	Expected Canadian Catch
COMMUNITY ECONOMIC DEVELOPMENT PROGRAM			
BELLA BELLA	Chum	212,552	4,038
	Coho	55,650	4,507
CHEHALIS R.	Chum	2,936,000	20,552
CLAYOQUOT	Coho	27,000	324
	Sockeye	9,450	85
	Chinook	34,076	452
COWICHAN R.	Coho	167,188	1,672
	Chinook	375,780	7,516
DEADMAN R.	Chinook	30,629	230
FORT BABINE	Coho	94,348	4,838
	Chinook	76,998	1,363
FORT ST. JAMES	Chinook	138,767	1,041
HARTLEY BAY CR.	Coho	90,672	2,720
KINCOLITH	Coho	14,366	1,437
	Chinook	750	15
KISPIOX R.	Coho	118,188	5,251
	Chinook	313,908	4,842
	Steelhead	19,660	197
KITSUMKALUM R.	Chum	98,509	1,675
	Coho	56,368	1,127
KLEMTU	Chum	330,461	6,279
	Coho	6,984	698
MASSET	Chinook	75,500	958
NANAIMO R.	Coho	254,195	2,542
	Chinook	206,096	4,122
NIMPKISH	Chum	886,921	10,402
	Coho	50,377	504
	Sockeye	510,787	4,597
	Chinook	304,318	5,754
OWEKENO	Chum	271,000	5,022
	Chinook	175,791	2,027
P.HARDY/QUATSE	Pink	4,224,000	63,360
	Chum	181,307	1,669
	Coho	353,219	4,547
	Steelhead	63,597	2,257
P.HARDY/STEPHENS	Chum	881,128	6,294
	Coho	323,850	4,663
PENNY	Chinook	71,953	184
POWELL R.	Chum	94,996	1,615
	Coho	274,958	8,604
	Chinook	179	3
SAN JUAN R.	Chum	34,300	412
	Coho	970,573	19,042
	Chinook	300,000	4,200
SECHELT	Chum	60,799	730
	Coho	79,896	7,990
	Chinook	73,253	1,435
SEYMOUR R.	Coho	72,624	7,262
	Chinook	68,655	1,167
	Cutthroat	705	11
	Steelhead	34,763	563
SKIDEGATE	Chum	60,124	710

How to READ THIS TABLE:

This table shows the number of adult fish expected during the years 1989 to 1991, (depending on the species) to result from 1987 releases, and the anticipated contribution to catches. For example, Bella Bella hatchery released 212,552 chum juveniles in 1987. These should result in an adult population of 4,038 of which 2,798 will be caught in the various fisheries.

Species	Juveniles Released	Expected Adult Production	Expected Canadian Catch
SLIAMMON R.	Coho	30,680	787
	Chum	960,000	16,320
	Coho	44,518	1,674
TERRACE	Coho	35,014	700
	Chinook	265,648	3,605
	Steelhead	16,737	167
THOMPSON R. NORTH	Coho	118,709	2,826
THORNTON CR.	Coho	241,853	6,088
	Chinook	74,070	1,037
TOBOGGAN CR.	Coho	64,409	6,441
	Chinook	56,607	1,132
	Steelhead	180,222	1,802
FISHWAYS AND UNMANNED CHANNELS			
	Pink	37,237,500	558,563
	Chum	5,940,000	41,580
	Coho	5,625,000	45,000
	Chinook	25,000	50
ENHANCEMENT OPERATIONS			
BIG QUALICUM R.	Chum	48,060,000	336,420
	Coho	1,472,413	147,241
	Chinook	7,021,836	140,437
	Cutthroat	8,858	886
	Steelhead	35,202	1,408
BIRKENHEAD R.	Coho	62,853	2,867
	Chinook	173,000	680
	Steelhead	6,553	66
CAPILANO R.	Coho	683,641	61,380
	Chinook	2,065,635	35,116
	Cutthroat	902	90
	Steelhead	17,421	697
CHEHALIS R.	Chum	13,539,833	230,177
	Coho	826,574	82,657
	Chinook	543,355	9,237
	Cutthroat	37,438	3,744
	Steelhead	127,923	4,722
CHEMAINUS R.	Coho	73,870	739
	Chinook	190,650	3,813
CHILLIWACK R.	Chum	4,480,012	76,160
	Coho	1,934,406	193,441
	Chinook	715,061	12,156
	Steelhead	124,044	4,962
CLEARWATER R.	Coho	510,900	10,218
	Chinook	2,094,845	15,711
CONUMA R.	Chum	15,067,088	256,141
	Coho	226,483	13,748
	Chinook	2,184,172	30,408
EAGLE R.	Coho	898,849	20,823
	Chinook	843,072	6,990
FULTON R.	Sockeye	144,833,000	1,433,847
GATES R.	Sockeye	3,287,820	32,549
INCH CR.	Chum	7,384,027	125,528
	Coho	436,119	39,348
	Chinook	126,106	2,144
	Cutthroat	32,012	3,060
KITIMAT R.	Chum	1,047,946	17,815
	Coho	700,059	62,616
	Chinook	2,671,004	32,052
	Cutthroat	716	72
	Steelhead	54,035	2,161
LITTLE QUALICUM R.	Chum	43,982,527	346,417
	Chinook	1,717,579	34,352
	Steelhead	29,886	1,195
NADINA R.	Sockeye	3,877,000	38,382
NITINAT R.	Chum	16,576,680	281,804
	Coho	103,798	2,076
	Chinook	4,298,090	59,513
PALLANT CR.	Chum	9,843,401	161,004

1987 RELEASE YEAR

FISH
PRODUCTION

	Species	Juveniles Released	Expected Adult Production	Expected Canadian Catch		Species	Juveniles Released	Expected Adult Production	Expected Canadian Catch	
PINKUT CR. PITT R. UPPER PUNTLEDGE R.	Coho	390,307	9,758	4,344	FRASER R. NORTHSIDE	Chum	403,600	5,116	2,192	
	Chinook	43,177	324	117		Coho	263,900	12,821	7,459	
	Sockeye	74,428,000	736,837	275,577		Chinook	13,000	221	155	
	Sockeye	259,354	2,568	685		Cutthroat	11,600	1,160	777	
	Pink	3,147,923	61,919	37,151		Steelhead	8,600	260	156	
	Chum	4,912,202	83,507	36,743						
	Coho	2,038,722	53,815	38,343						
	Chinook	4,063,868	81,277	45,515						
QUESNEL R.	Steelhead	22,346	785	393	■ PROVINCE OF BRITISH COLUMBIA					
	Coho	24,458	734	470		COWICHAN L. BCFW	Steelhead	67,223	2,689	1,345
	Chinook	2,427,350	18,390	6,896		FRASER VALLEY BCFW	Cutthroat	61,175	4,021	2,694
				Steelhead		249,346	2,316	1,390		
QUINSAM R.	Pink	7,114,887	128,096	76,858	VANCOUVER IS. BCFW	Cutthroat	14,108	1,411	945	
	Coho	1,548,235	133,714	96,976		Steelhead	290,248	4,742	2,371	
	Chinook	3,309,672	66,193	42,152						
ROBERTSON CR.	Steelhead	37,273	1,087	544	■ SMALL PROJECTS UNIT					
	Coho	1,155,807	57,790	34,371		ALOUETTE R.	Chum	1,037,205	17,632	7,448
	Chinook	8,970,944	123,707	58,786		Coho	91,105	9,111	5,830	
	Steelhead	156,552	5,714	5,101		Cutthroat	41,141	4,114	2,756	
SHUSWAP R. SNOOTLI CR.	Chinook	1,724,800	12,936	4,851		Steelhead	36,664	1,467	880	
	Chum	7,426,137	116,508	80,740	B.C. RAIL. CHAN.	Chum	1,000,000	14,000	6,160	
	Coho	133,093	2,662	1,883		Coho	3,000	450	228	
Chinook	1,993,548	14,952	5,831	BILLY HARRIS SLOUGH		Chum	1,500,000	21,000	8,871	
SPIUS CR.	Cutthroat	18,235	292	196		Coho	11,240	1,686	1,079	
	Steelhead	134,961	942	471	CHILQUA CR.	Chum	500,000	7,000	2,957	
	Coho	677,090	20,337	13,013		Coho	1,200	180	115	
	Chinook	1,609,825	8,177	3,066		COLONIZATION PROJ.	Coho	247,195	2,473	1,762
TENDERFOOT CR.	Steelhead	558,670	5,587	3,352		Coho	2,500	375	240	
	Coho	162,632	14,465	7,317	ED LEON SLOUGH	Chum	1,500,000	21,000	8,871	
	Chinook	497,230	7,357	5,153		Coho	8,700	1,305	835	
	Steelhead	94,621	606	303	HICKS CR. POND	Coho	8,000	1,200	768	
WEAVER CR.	Chum	234,765	1,643	694	HOPEDALE SLOUGH	Chum	150,000	2,100	887	
	Sockeye	19,144,033	189,526	50,566			Coho	4,000	600	384
WHITEHORSE	Chinook	290,544	2,179	61	JUDD SLOUGH	Chum	2,600,000	36,400	16,016	
■ PUBLIC INVOLVEMENT PROGRAM						Coho	7,800	1,170	592	
	VANCOUVER IS. N.	Chum	134,087	1,674	746	KITSUMKALUM L.	Sockeye	250,000	2,475	926
		Coho	819,675	14,761	9,658	KITWANCOOL CHAN.	Pink	450,000	11,250	5,878
		Chinook	1,148,482	16,877	8,656	MAMQUAM R.	Chum	769,669	10,775	4,741
VANCOUVER IS. S.	Steelhead	3,000	30	12		Coho	4,500	675	341	
	Chum	100,683	705	310	MCNAB CHAN.	Chum	42,000	588	259	
	Coho	280,295	4,616	2,932	MOODIE'S CHAN.	Chum	1,500,000	21,000	9,240	
	Chinook	110,238	1,426	688	PARADISE CHAN. LOWER	Chum	1,500,000	21,000	9,240	
VANCOUVER IS. CENT.	Pink	1,600,000	24,000	14,400		Coho	1,300	195	99	
	Chum	254,000	2,938	1,301	PARADISE CHAN. UPPER	Chum	250,000	3,500	1,540	
	Coho	925,989	16,130	10,910		Coho	7,800	1,170	592	
	Chinook	648,000	12,523	7,013	PEACH CR.	Chum	1,500,000	21,000	8,871	
SUNSHINE COAST	Steelhead	3,000	30	15		Coho	13,500	2,025	1,296	
	Chum	223,875	3,053	1,343	RAILROAD CR.	Chum	350,000	4,900	2,070	
	Coho	191,198	6,105	3,153		Coho	250	38	24	
	Sockeye	15,000	135	95	RYDER CR.	Chum	150,000	2,100	887	
QUEEN CHARLOTTE IS.	Cutthroat	2,800	280	188	SEABIRD CHAN.	Chum	18,900	265	112	
	Steelhead	16,000	160	84		Sockeye	14,100	140	37	
	Chum	200,635	2,121	904	VANCOUVER BAY	Chum	244,500	4,057	1,785	
	Coho	321,325	4,698	2,095		Coho	30,625	919	465	
CENTRAL INTERIOR	Steelhead	4,670	47	24		Chinook	22,750	265	186	
	Coho	111,095	2,654	1,700		Steelhead	13,000	83	42	
	Chinook	262,692	746	280	WESTHOLME CHAN.	Chum	1,500,000	21,000	9,240	
	Steelhead	500	15	9		Coho	1,300	195	139	
NORTH COAST/INTERIOR	Pink	8,000	120	3	WORTH CR.	Chum	350,000	4,900	2,070	
	Chum	6,000	42	4		Coho	8,000	1,200	768	
	Coho	401,630	7,759	3,232	■ LAKE ENRICHMENT PROGRAM					
	Chinook	26,000	286	8		GREAT CENTRAL L.	Sockeye	6,030,000	271,350	165,524
FRASER R. SOUTHSIDE	Chum	85,000	595	256		HENDERSON L.	Sockeye	1,328,000	59,760	36,454
	Coho	94,338	3,582	1,909		KENNEDY L.	Sockeye	385,064	17,328	10,570
	Chinook	18,000	306	214	LONG L.	Sockeye	2,315,000	104,175	57,296	
	Cutthroat	12,000	1,200	804	NIMPKISH L.	Sockeye	1,922,000	86,490	48,434	
	Steelhead	12,000	480	240	SPROAT L.	Sockeye	6,904,000	310,680	189,515	

**FISH
PRODUCTION**
BY PROGRAM 1987 Release Year

PROGRAM AREA	NO. OF PROJECTS	SPECIES	JUVENILES RELEASED	EXPECTED ADULT PRODUCTION	EXPECTED CANADIAN CATCH
COMMUNITY ECONOMIC DEVELOPMENT PROGRAM	28	Pink	4,224,000	63,360	38,016
		Chum	7,008,097	75,718	37,453
		Coho	3,545,639	96,244	54,446
		Sockeye	520,237	4,682	2,626
		Chinook	2,642,978	41,083	20,933
		Cutthroat	705	11	7
		Steelhead	314,979	4,986	2,710
			18,256,635	286,084	156,191
ENHANCEMENT OPERATIONS	29	Pink	10,262,810	190,015	114,009
		Chum	172,554,618	2,033,124	918,737
		Coho	14,060,309	930,429	610,745
		Sockeye	245,829,207	2,433,709	882,011
		Chinook	49,575,363	718,101	380,383
		Cutthroat	98,161	8,144	5,456
		Steelhead	1,399,487	29,932	18,746
			493,779,955	6,343,454	2,930,087
FISHWAYS AND UNMANNED CHANNELS	3+	Pink	37,237,500	558,563	337,585
		Chum	5,940,000	41,580	28,214
		Coho	5,625,000	45,000	33,017
		Chinook	25,000	50	35
			48,827,500	645,193	398,851
LAKE ENRICHMENT PROGRAM	6	Sockeye	18,884,064	849,783	507,793
PUBLIC INVOLVEMENT PROGRAM (habitat/hatcheries/incubation)	354	Pink	1,608,000	24,120	14,403
		Chum	1,407,880	16,244	7,056
		Coho	3,409,445	73,126	43,048
		Sockeye	15,000	135	95
		Chinook	2,226,412	32,385	17,014
		Cutthroat	26,400	2,640	1,769
		Steelhead	47,770	1,022	540
	350		8,740,907	149,672	83,925
PROVINCE OF B.C.	3	Cutthroat	75,283	5,432	3,639
		Steelhead	606,817	9,747	5,106
			682,100	15,179	8,745
SMALL PROJECTS UNIT	28	Pink	450,000	11,250	5,878
		Chum	16,462,274	234,217	101,265
		Coho	452,015	24,967	15,557
		Sockeye	264,100	2,615	963
		Chinook	22,750	265	186
		Cutthroat	41,141	4,114	2,756
		Steelhead	49,664	1,550	922
			17,741,944	278,978	127,527
TOTAL PRODUCTION			606,913,105	8,568,343	4,213,119

BY SPECIES 1987 Release Year

Pink	53,782,310	847,308	509,891
Chum	203,372,869	2,400,883	1,092,725
Coho	27,092,408	1,169,766	756,813
Sockeye	265,512,608	3,290,924	1,393,488
Chinook	54,492,503	791,884	418,551
Cutthroat	241,690	20,341	13,627
Steelhead	2,418,717	47,237	28,024
TOTAL PRODUCTION	606,913,105	8,568,343	4,213,119